The determination of sex

STRASBURGER'S latest work deals with the time of the determination of sex, apogamy, parthenogenesis, and the reduction division.[4]

The discussion in regard to the determination of sex is based largely upon the behavior of the spores of the dioecious liverwort Sphaerocarpus. Two spores of a tetrad give rise to male plants and the other two give rise to females. The conclusion is that the sex tendencies are separated during the two mitoses by which the four spores are formed from a mother cell. In the homosporous pteridophytes with monoecious prothallia, the expression of the sex tendency, as shown by the formation of antheridia and archegonia, does not take place so early, and in heterosporous pteridophytes all the spores of a tetrad, and even of a sporangium, produce plants of one sex. This is true also of spermatophytes, all of which have strictly dioecious gametophytes. STRASBURGER concludes, as had also CORRENS and NOLL, that the egg tends to produce females, and he believes that the mitoses in the pollen mother cell separate male tendencies of unequal vigor, so that, in dioecious plants, two microspores of a tetrad will give rise to sperms, which, in fertilizing the egg, are prepotent over the female tendency and so will produce males. The other two microspores of the tetrad will give rise to sperms which are not able to overcome the female tendency of the egg, and hence it will produce females. The hybrid obtained by pollinating *Fragaria virginica* with the pollen of *F. elatior* has been explained as a case of merogeny, but STRASBURGER found that fertilization occurs regularly, and that both male and female plants are produced. All the plants, however, resemble the male. This shows that the heritable characters of one of the nuclei which unite in fertilization can dominate the other. There is, as yet, no cytological evidence of the separation of sex-determining structures in plants.

Aside from a critical review of the literature, the discussion of apogamy is based principally upon an investigation of *Wikstroemia indica*, and 62 of the 88 figures illustrate critical stages in the life-history of this plant. As in other apogamous forms, the chromosome number is higher than in normal related species. In the pollen mother cells the mitoses differ from those of normal plants, and pollen tubes are never formed. The first mitosis in the megaspore mother cell shows some abnormalities. A wall is formed between the two daughter nuclei, but at the next mitosis, which usually occurs only in the lower cell, no wall is formed. An eight-nucleate embryo sac with a $2x$ egg is formed from the lower cell, and from this egg the $2x$ embryo is formed without fertilization. STRASBURGER regards this as a case of apogamy (*Eiapogamie*), and would reserve the term parthenogenesis for the development of an embryo from an egg with the reduced number of chromosomes. The reason for the discrimination is that he regards the $2x$ eggs as practically already fertilized.

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[4] STRASBURGER, EDUARD, Zeitpunkt der Bestimmung des Geschlechts, Apogamie, Parthenogenesis und Reduktionsteilung. Histologische Beitrage VII. 8vo. pp. xvi + 124. *pls.* 1–3. Jena: Gustav Fischer. 1909. *M.* 6.50.

In the heterotypic mitosis STRASBURGER interprets the double condition as a parallel conjugation and not as an early splitting, and in this parallel conjugation he finds the explanation of the reduction from the $2x$ to the x number of chromosomes. *Galtonia candicans* furnishes particularly strong evidence that there is a pairing rather than a splitting.

STRASBURGER was one of the first to claim that the nucleus is the physical basis of heredity. Since it has been urged that other structures are concerned, the sperm nuclei of Lilium were carefully reexamined, and it was found that only the nucleus, with no trace of cytoplasm from the pollen tube, enters the egg.

The book closes with some interesting suggestions in regard to the origin and development of the nucleus: The original protoplasm had no nuclei, all its parts being capable of both formative and nutritive functions. Then there was a gradual separation of formative and nutritive parts, and the formative parts were the first differentiated carriers of hereditary qualities. At first they were scattered in the cytoplasm, but later became grouped, as in the Cyanophyceae. Next the nucleus would be marked off from the cytoplasm by a membrane. Simple constriction might suffice for the division of such a nucleus, but as the difference between hereditary units became so great that each unit carried only one quality, a more exact division would become necessary. The units would become arranged longitudinally in a thread, where they would undergo a doubling, and the longitudinal division of the thread would separate the product of that doubling. The complete resemblance between the mitoses of higher plants and animals makes this sequence very probable.

The book touches upon almost every phase of cytological investigation and consequently only a few of its more important features can be mentioned in a review.—CHARLES J. CHAMBERLAIN.

Biology of chlorophyll

Starting from the complementary colors of marine algae, an accepted adaptation to the light at varying depths, as suggested by ENGLEMANN (1883), and the complementary tints attained promptly by certain Oscillatoriae, when exposed to light of differing hues, as shown by GAIDUKOW (1902), STAHL proposes to inquire[5] why plants are green and not some other color, and whether the green of land and water plants is not an adaptation to the composition of sunlight, modified by its passage through the atmosphere. Citing the results of physical investigations to show that in diffuse light the blue and violet rays prevail, and in direct sunlight the red and yellow, he claims that an unrecognized relation exists between these facts and the selective absorption of the chlorophyll. The yellow component serves to absorb the blue-violet; the green component the red-yellow. The yellow pigment is complementary to the blue of the sky, and the green to the red-yellow rays which pass through an atmosphere whose haziness becomes evident to our

[5] STAHL, ERNST, Zur Biologie des Chlorophylls: Laubfarbe und Himmelslicht: Vergilbung und Etiolement. 8vo. pp. vi+154. *pl.* 1. Jena: Gustav Fischer. 1909. *M* 4.